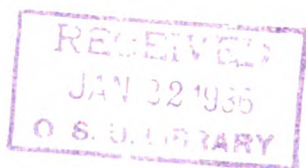


DEPARTMENT OF THE INTERIOR

UNITED STATES BUREAU OF MINES
= JOHN W. FINCH, DIRECTOR =

INFORMATION CIRCULAR

ELECTRIC CAP LAMPS IN ALABAMA MINES, 1935



BY

FRANK E. CASH

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DEPARTMENT OF THE INTERIOR - BUREAU OF MINES

ELECTRIC CAP LAMPS IN ALABAMA MINES, 1935¹

By Frank E. Cash²

INTRODUCTION

As a part of its safety program the United States Bureau of Mines has fostered the development, use, and improvement of portable electric mine lamps. Although there is still need for better illumination in mines and the replacement of open lights has been slow, improvement in electric cap lamps and increase in their use indicate one phase of recent progress toward safer and more efficient mining.

This report is the result of a recent survey of electric-lamp installations in the Alabama mining district; it shows the misuse, increase in use, and relation to certain classes of accidents of these installations.

ACKNOWLEDGMENTS

The assistance given by representatives of the lamp manufacturers, lamp-maintenance men, operating officials, and the State Mining Department has made this report possible and is accordingly acknowledged.

REVIEW OF LAMP INSTALLATIONS

Small test or experimental electric cap-lamp installations were made in 1916, but the first complete installation was made on July 1, 1918 in the Virginia mine of the Gulf States Steel Co., the first mine in Alabama that required all its underground employees to be equipped with electric cap lamps.

From the first complete installation until March 1928 (a period of 10 years) the number of installations increased from 1 to 30 and the number of lamps from 200 to 3,600, with complete installations by 10 operating companies in 20 mines and 5 small installations for special use.³

¹ The Bureau of Mines will welcome reprinting of this information circular, provided the following footnote acknowledgment is used: "Reprinted from U. S. Bureau of Mines Information Circular 6865."

² District engineer, U. S. Bureau of Mines Safety Station, Birmingham, Ala.
³ Cash, F. E., Portable Electric Cap Lamps in Alabama: Rept. of Investigations 2859, Bureau of Mines, 1928, 13 pp.

At present 10,482 electric cap lamps are in use in Alabama. Seventeen companies have complete installations in 40 operating mines; in addition, 7 mines now closed used electric cap lamps and had 4 small installations for special use.

Although coal production has decreased approximately 50 percent during the past 5 years the use of electric cap lamps has increased 250 percent.

Table 1 gives data on location and number of lamps used in Alabama mines.

Lamps for Animal Haulage

Electric safety mule lamps for mine haulage were first used in Alabama by the Alabama Fuel & Iron Co. in December 1931;⁴ they are now used by 4 other companies operating 14 mines with 198 electric mule lamps. A direct saving is effected in lives of mules and an indirect saving by enabling each mule to travel faster and transport more coal; possibly also accidents to men are prevented through use of these lamps.

Relation of Lamps to Men and Production

From 1917 to 1928 an average of 21,000 men underground produced approximately 19,000,000 tons of coal annually. In 1934, according to the Alabama Department of Mines, 15,797 men underground produced 9,600,792 tons of coal.

In 40 mines with complete lamp installations 7,756 men (49.1 percent of the total number underground) produced 5,258,495 tons of coal (54.9 percent of the total Alabama coal production).

⁴ Cash, F. E., and Saxon, C. E., Portable Electric Lamps for Animal Haulage in Alabama: Inf. Circ. 6712, Bureau of Mines, 1933, 5 pp.

TABLE 1.--Electric cap-lamp installations in Alabama mines

Company	Town	Mine	Lamps	
			Man	Mule
Alabama Fuel & Iron Co.	Acmar	Acmar 5	350	36
Do	do	Acmar 6 <u>1</u>	47	
Do	do	New Acton 3	141	14
Do	do	New Acton 5	138	12
Do	Margaret	Margaret 3,6,8	580	40
Alabama By-Products Corp.	Cordova	Barney	400	
Do	Dixiana	Bradford	550	
Do	Praco	Praco 7,7 $\frac{1}{2}$,10	960	
Blocton Coal & Coke Co.	Coleanor	Coleanor	200	10
Brookside-Pratt Mining Co.	Adamsville	Blossburg E	225	
Do	Winfield	New River	100	
Do	Carbon Hill	Warrior River 2,3	225	
Black Diamond Coal Mining Co.	Johns	Adger	226	40
Do	do	Johns	117	10
Do	do	Sumter	60	5
Do	do	No. 14	37	5
DeBardeleben Coal Corp.	Townley	Townley	270	
Franklin Coal Mining Co.	Powhatan	No. 1	300	
Hammond Iron Co.	Labuco	Labuco	253	
Galloway Coal Co.	Carbon Hill	Mill Creek	185	
Gulf States Steel Co.	Sayre	Sayre <u>1</u>	80	
Do	Virginia	Virginia <u>1</u>	25	
New Castle Coal Co.	New Castle	New Castle	310	
Little Cahaba Coal Co.	Piper	No. 1	60	
Do	do	No. 2	250	22
Montevallo Coal Mining Co.	Aldrich	Aldrich	225	
Peerless Coal Co.	Straven	Peerless <u>1</u>	150	
Red Diamond Coal Co.	Leeds	Red Diamond	150	
Stith Coal Co.	America	Bon Air <u>2</u>	12	
Southern Coal & Coke Co.	Boothton	Nos. 1 and 2	220	
Do	do	Nos. 3 and 4	128	
Sloss Sheffield Steel & Iron Co.	Maben	Bessie <u>1</u>	250	
Do	Lewisburg	Lewisburg	600	
Do	Flat Top	Flat Top	300	
Do	Alden	Flat Top	450	
Tennessee Coal, Iron and Railroad Co.	Pratt City	Hamilton <u>2</u>	60	
Do	Birmingham 8	Land Dept <u>2</u>	12	
Woodward Iron Co.	Dolomite	Dolomite	600	
Do	Mulga	Mulga	400	
Republic Steel Corp.	Sayreton	No. 1	460	
Do	do	No. 2	180	
Yolande Coal & Coke Co.	Yolande	Connellsville <u>1</u>	184	

1 Closed
2 Special

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Electric Lamps, Gas Ignitions, and Explosions

From 1894 to 1929 Alabama has a record of 127 gas ignitions and explosions, each killing 1 or more men (a total of 1,003 fatalities); 80 percent of these ignitions were from open lights. 5

From 1930 to 1934, inclusive, 4 gas ignitions killed 1 or more each, with a total of 14 fatalities; 1 of the 4 ignitions in which 1 man was killed was caused by an open light.

Although efficient ventilation is of paramount importance in reducing or eliminating gas ignitions and the use of rock dust and water is equally important in preventing widespread explosions, electric cap lamps play an important role; up-to-date cap lamps give the mine worker far stronger and more dependable lighting than he can otherwise obtain. He can therefore work much more safely and efficiently than with the other less effective types of lighting formerly used.

Maintenance and Use of Lamps

Maintenance and use of lamps in most installations insure maximum efficiency and safety; abuses, however, have been brought to the attention of the operators so they might check their installations and correct irregularities in their maintenance and use; these were:

1. Removing seals from headpieces, permitting access to live terminals.
2. Removing battery covers or drilling holes through the covers to permit access to battery terminals.
3. Removing lock dogs from headpieces as an aid to self-service or to permit shot firing from charging terminals.
4. Using broken lenses or substituting special lenses not covered by approval.
5. Polishing, enameling, or otherwise changing the surface of the reflector.
6. Using bulbs not approved with the lamp and not bearing the corresponding approval marking on the bulb base; lamps bearing approval 25 should use bulbs marked "BM-25", "BM-25-A", or "BM-25-B."
7. Using lamps without emergency bulbs or filaments.

5 Cash, F. E., and Humphrey, H. B., Explosions in Alabama Coal Mines: Inf. Circ. 6352, Bureau of Mines, 1930, 8 pp.

8. Failure to follow manufacturer's instructions relative to charging, maintaining the proper level of the electrolyte, keeping all electrical connections clean and intact, and daily inspection of the lamps to detect needed repairs and replacements.

CONCLUSIONS

The conclusions in Information Circular 6832 ⁶ are so appropriate to the proper use and maintenance of electric cap lamps in Alabama mines that they are repeated with a few alterations in this report.

The Bureau of Mines became interested in electric cap lamps because it saw in them a safer and more efficient means of lighting mines than with open-flame lamps. The Bureau undertook the sponsorship not only of the safety but also of the practicability of electric cap lamps in order that these lamps might be adopted as early and as widely as possible. The need for safe illumination still exists, as more than half of the miners in the United States still use open lights; the Bureau still advocates the further use of electric cap lamps.

The operator should insist that his lamps be kept in good working order for three reasons: (1) Better lighting affords greater safety to the user and results in fewer accidents and less compensation for injuries; (2) better lighting pays in increased tonnage and cleaner coal; (3) if the lamps are not properly maintained they may actually become hazardous and will lose favor and their introduction be retarded.

The keyman in proper lamp maintenance is the lamp attendant. The operator can do much by selecting proper lamp attendants and in furnishing enough help and supplies to do the job adequately. The lampman should keep account of the repairs made on each lamp. Such an account will disclose the careless or malicious user.

Observations and data of various lamp installations indicate that an attractive lamphouse, cleanly and neatly maintained is likely to inspire careful use of lamps. In some places a system of prizes for exceptionally good care of lamps will help; in others a system of charging all breakage of lamps against the individual miner is likely to be more effective.

Each user should report any damage to his lamp, including a burned-out filament or any flickering of his light. Any just complaint should be given courteous attention by the lamp attendant.

⁶ Zellers, D. H., and Hooker, A. B., Maintaining the Permissibility of Electric Cap Lamps: Inf. Circ. 6832, Bureau of Mines, 1935, pp.10-12

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The permissible electric cap lamp is an ideal source of illumination for the purpose intended. It follows each movement of the head, directing the light on the objective sought, and does not cause a man to cast a shadow in the path of this light. It gives him vision at his feet, which is essential for safe traveling, and yet does not decrease the efficiency of the rays by throwing them outside his field of vision. Its primary purpose is to give adequate illumination and remove the hazard attending the use of open lights. A cap lamp in a permissible condition embodies the features designed to accomplish that end.

Safety can be assured by keeping the battery cover and head-piece locked, sealed, or properly fastened in place, as the case may be, and all parts in working order. Maximum efficiency can be maintained by keeping a close check on the condition of the battery, the bulb, and the reflector and current-carrying contacts.

The Bureau of Mines does not infer that permissible cap lamps are perfect or that in them the ultimate in safety or efficiency has been attained; cap lamps are continually being improved. Neither does it infer that the layman is incapable of improving a permissible cap lamp; many important developments have resulted from suggestions of the user in the field. However, before any contemplated alterations of permissible equipment are made it is recommended that the manufacturer be consulted; he will undoubtedly appreciate any practical suggestions for improvement in design or construction.

It is hoped that this paper will encourage and stimulate a greater interest in maintenance of portable electric lamps and discourage the use of unapproved parts, as they usually decrease the efficiency of the lamps and may result in a potential hazard.

The up-to-date permissible electric cap lamps are so much superior to any known type of underground individual miner's light that regard for efficiency demands that all underground workers be equipped with them even if the safety features should be ignored. However, these lamps, like all other kinds of mechanical or electrical devices or equipment, require constant, careful, intelligent attention even to approach their possible efficiency; failure to give them this care is almost certain to result in partial or possibly complete failure of the lighting effectiveness of the lamps, and reasonable care is certain to give excellent light.